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Research Note

Hexametra boddaertii (Nematoda: Ascaridae) in the Sidewinder, *Crotalus cerastes* (Crotalidae), from California

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ABSTRACT: Examination of 40 sidewinder rattlesnakes, *Crotalus cerastes,* revealed the presence of the nematode *Hexametra boddaertii* (prevalence 5%, mean intensity 3.5) in the small intestine. This is a new host record and the first report of a natural infection by the genus *Hexametra* in California.

KEY WORDS: Nematoda, Ascarididae, *Hexametra boddaertii,* Reptilia, Viperidae, *Crotalus cerastes.*

The sidewinder, *Crotalus cerastes* Hallowell, 1854, ranges from southern Nevada and extreme southwestern Utah into northeast Baja California, northwest Sonora to southcentral Arizona from below sea level to around 1,830 m (Stebbins, 1985). It is sympatric with a number of snakes: predominantly, coachwhip, *Masticophis flagellum* (Shaw); gopher snake, *Pituophis catenifer* (Blainville); glossy snake, *Arizona elegans* Kennicott; and western shovelnose snake, *Chionactis occipitalis* (Hallowell); but also western blind snake, *Leptotyphlops humilis* (Baird and Girard); rosy boa, *Lichanura trivigata* Cope; spotted leafnose snake, *Phyllorhynchus decurtatus* (Cope); western patchnose snake, *Salvadora hexalepis* (Cope); common kingsnake, *Lampropeltis getula* (Linnaeus); longnose snake, *Rhinocheilus lecontei* Baird and Girard; night snake, *Hypsiglena torquata* (Günther); lyre snake, *Trimophodon biscutatus* (Duméril, Bibron and Duméril); speckled rattlesnake, *Crotalus mitchelli* (Cope); and Mojave rattlesnake, *Crotalus scutulatus* (Kennicott).

Hexametra boddaertii (Baird, 1860) Kreis, 1944, was originally described from a single female specimen taken from a South American colubrine snake, *Mastigodryas boddaerti* (Sentzen) Stuart. Baylis (1916, 1920) redescribed the specimen and placed the species in the genus *Polydelphis* Dujardin, 1845, because the specimen had more than 2 uterine branches. Kreis (1944) subsequently transferred the species to the genus *Hexametra,* a genus created by Travassos (1920) to house ascaridoids with 6 uterine branches. In 1978, Sprent reviewed the genus and placed *Ascaris quadrangularis* Schneider, 1866, *Polydelphis hexauterina* Skrjabin, 1916, and *Hexametra quadricornis* (Wedl, 1861) sensu Araujo, 1969, in synonymy with *H. boddaertii.* Sprent (1978) also examined specimens of *Hexametra* in the collection of the U.S. National Parasite Collection and found that they were *H. boddaertii*; he therefore concluded that all specimens of *Hexametra* from the Western Hemisphere represented a single species. However, specimens collected from *Crotalus horridus* Linnaeus and *Agkistrodon piscivorus leucostoma* (Troost) from Louisiana were described by Bowman (1984) as *Hexametra leidyi.* These 2 species, *H. boddaertii* and *H. leidyi* represent the genus in North American snakes.

This note reports the presence of *H. boddaertii* in *Crotalus cerastes* from California. This finding represents a new host and locality record and what we believe to be the second report of an infection by this parasite in a wild population of North American snakes.

Forty *Crotalus cerastes* (21 male, 19 female, mean snout–vent length [SVL] 49.0 ± 6.0 cm, range 34.1–61.4 cm) were collected in the Kelso Dunes 3.5 km south of Kelso, San Bernadino County, California, elevation 650–700 m, 34°59′N, 115°57′W, in September 1991 for use in a doctoral dissertation (Secor, 1992). The snakes were subsequently searched for endoparasites. The body cavity was opened ventrally and the gastrointestinal system and body cavity examined. Nematodes were cleared in glycerol for microscopic examination. Five of the 40 specimens were deposited in the herpetology collection of the Los Angeles County Museum of Natural History (LACM 140779–140783).

Two of 40 (5% prevalence) *Crotalus cerastes* harbored nematodes: 3 adult, white cylindrical

ascarid nematodes tapering both anteriorly and posteriorly but with greater thickness in the posterior half of the body were found in the small intestines of LACM 140779 (female, 61.4 cm SVL); LACM 140781 (female, 54.7 cm SVL) harbored 4 larval ascarids on visceral fat bodies within the coelom. The male specimen measured 90 mm, width at midbody 2 mm; both female specimens measured 130 mm, width at vulva 2.4 mm; larvae measured 2.4–2.7 mm in length. Each possessed 3 equally sized lips, a dorsal and 2 lateroventral, with rounded angles, slightly wider than long. In the adults, the anterior border of each lip was serrated with tiny teeth (male, 98 teeth; females, 83, 87 teeth); the denticles did not reach the base of the lip. A ventriculus was absent; there were no esophageal or intestinal caeca. The intestine had a dark brown coloration that remained throughout the length of the body. The testes were irregularly coiled, reaching 39 mm from the posterior end. The cloacal orifice was 0.25 mm from the terminus. The tail of the male was short, in the form of a cone and provided with 2 pairs of ventral and 4 pairs of sublateral papillae. There were 50 pairs of precloacal papillae. The spicules were equal, well sclerotized, and 1.25 mm in length and tapered to a point distally. The vulva was located midbody; the rest of the female reproductive system was in the posterior half of the body. The vagina was 4.2 mm in length and directed posteriorly; the unbranched portion of the 6 branched uterus was 3.25 mm. The anterior ovarian branches approached the vulva but did not extend anterior of it, and posteriorly they did not reach the anus. The eggs were subspherical, 79–85 μm by 71–82 μm. (U.S. National Museum Helminthological Collection, Beltsville, Maryland 20705, Accession No. 83512: *Hexametra boddaertii*; 83512: ascarid larvae).

The adult nematodes were identified by utilizing 3 differential characters that Bowman (1984) established for separating *H. boddaertii* from *H. leidyi*: the number and distribution of the denticles on the lips and the size of the eggs. That is, in *H. boddaertii* the dentigerous ridge extends to the level of the anterior margin of the double papilla whereas in *H. leidyi* the dentigerous ridge extends to the base of each side of the lip; *H. boddaertii* has fewer denticles (79–103) than *H. leidyi* (141–216); and the egg size of *H. boddaertii* is smaller (72–86 μm by 65–82 μm) than that of *H. leidyi* (84–96 μm by 74–89 μm). Thus, LACM 140779 harbored 1 male and 2 female *Hexametra boddaertii* in the small intestines.

The genus *Hexametra* contains 7 species, 4 from lizards and 3 from snakes (see Baker, 1987). Sprent (1978) considered all ascarids with 6 uterine branches from Old World snakes to belong to *H. quadricornis* and synonymized 15 species of nematodes with *H. quadricornis*; likewise, all ascarids with 6 uterine branches from New World snakes were considered to belong to *H. boddaertii* and he synonymized 3 species with *H. boddaertii*. The range of *H. boddaertii* in North America cannot be determined because all but 1 of the specimens in the U.S. National Parasite Collection were from zoo animals; the only noncaptive host was a "rattlesnake" collected in central Florida (Bowman, 1984). The other species of *Hexametra* from snakes is *H. leidyi* described by Bowman (1984) from *Crotalus horridus* and *Agkistrodon piscivorus leucostoma* from Louisiana. Bowman (1984) reported 1 additional occurrence of *H. leidyi*; that was in a western rattlesnake, *Crotalus viridis* (Rafinesque), that had been housed in the San Diego zoo. *Hexametra boddaertii* is the first species of the genus to be reported from the western United States and only the second nematode to be reported from *Crotalus cerastes*. *Thubunaea cnemidophorus* Babero and Matthias, 1967, was the first nematode, possibly a pseudoparasite, i.e., a secondarily ingested parasite of prey, to be reported from *Crotalus cerastes* (see Babero and Emerson, 1974).

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Research Note

Lack of Transmammary Transmission of *Strongyloides stercoralis* from a Previously Hyperinfected Bitch to Her Pups

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ABSTRACT: Larvae were not found by Baermann examination of the gastrointestinal tract or parenteral tissues of 7-day-old pups whelped by a bitch previously hyperinfected with *Strongyloides stercoralis* and either suckled on the bitch or fed an artificial milk diet. In sharp contrast, experimentally infected comparable pups yielded larvae when examined by the same technique. Additionally, although the bitch transiently shed larvae in the feces prior to whelping, larvae were not found in filtered aliquots of the bitch's milk from day 1 to day 7 after whelping, whereas they were recovered from filtered aliquots of *S. stercoralis*–seeded milk samples. These results suggest that transmammary and transplacental transmission of the parasite does not occur in dogs.

KEY WORDS: *Strongyloides stercoralis,* transmammary transmission, canine model.

Strongyloides stercoralis is a nematode parasite with the ability to replicate within its host allowing for accumulation of adult and larval forms, both in the gastrointestinal tract and in extraintestinal sites. It infects humans, primates, and dogs and is capable of causing serious disease leading to death in all of these hosts. The most severe manifestations of strongyloidiasis are hyper- and disseminated infection in which precociously developing third-stage larvae autoinfect the host, leading to massive numbers of, respectively, enteral and parenteral forms. *Strongyloides stercoralis*–infected dogs treated with corticosteroids have been shown to develop both hyper- and disseminated infections with the parasite (Grove et al., 1983; Schad et al., 1984; Genta et al., 1986; Mansfield and Schad, 1992) providing a good model for the study of the human disease. Infections by species of strongyloides are usually acquired by either of 2 routes: by direct penetration of the skin in unsanitary surroundings or by transmammary transmission.

Because transmammary transmission occurs in several other *Strongyloides* species, it has been suspected to occur in *S. stercoralis,* but this was never proven. Vertical transmission of other *Strongyloides* species in animals has been well documented, including *Strongyloides ransomi* in pigs (Moncol and Batte, 1966; Batte and Moncol, 1968), *Strongyloides westeri* in horses (Lyons et al., 1969), *Strongyloides papillosus* in sheep and cattle (Lyons et al., 1970), and *Strongyloides ratti* in rats (Katz, 1969; Zamirdin and Wilson, 1974). Additionally, reports have described the presence of infective larvae in the milk of *Strongyloides* spp. (*Strongyloides papillosus* group) (Grove, 1989) and *Strongyloides fulleborni*–infected women (Brown and Girardeau, 1976). Vertical transmission of *S. fulleborni* also has been shown to occur in primates (Wong and Conrad, 1978) and is suspected in humans in Papua, New Guinea (Ashford and Barnish, 1989). Conflict exists, however, in distinguishing the species of *Strongyloides* and, in particular, in differentiating *S. stercoralis* from *S. fulleborni* in both human and primate infections. The identity of

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